It Is Time for the Exoskeleton

Lethality isn't the problem; it's the combat load.

by CWO4 Jeffrey L. Eby

When I joined the Marine Corps, I wore a helmet, flak jacket, two canteens with cup, and a first aid kit. I had two magazine pouches that held six rifle magazines, and I could carry two fragmentation grenades on each of the magazine pouches. That was the extent of my combat load. I was only lethal during daylight for 500 yards. Our enemy at the time was expected to attack in massive armored columns, and I was expected to hold my ground and destroy the enemy in ever-reducing concentric rings of destruction in a technique called HAW, MAW, LAW (meaning heavy antiarmor, medium antiarmor, and light antiarmor weapons), or to destroy him in mass in a technique called "massed surprise fire." Our methodical approach to warfare was akin to constantly moving defensive positions. Our skills at hiking were the measurement of our abilities.

I dug a lot of fighting holes in the early years, until about 1986 when maneuver warfare became the great buzzword to replace methodical warfare. At this point we were still several years away from the technological boom that would hit us in the mid-1990s. Our assault loads were still manageable, and vehicle movement was more of a shuttle service than anything resembling motorized or mechanized warfare. We still wore butt packs because we spent more time walking than riding; therefore, the butt pack wasn't a problem yet.

Our methodical approach to warfare was akin to constantly moving defensive positions. Our skills at hiking were the measurement of our abilities.

Technology Boom

In the mid-1990s we hit a technological explosion and are still being buried by great combat gear. Today I wear a different helmet, an interceptor vest with small arms protective inserts, and have really increased what I carry, quadrupled what I have to be able to do, and decreased tenfold the amount of time that I have to learn all of my required skills.

Today I have a global positioning system (GPS) that I keep with me. I can still navigate, but time is critical, so instead of breaking out a lensatic compass and studying a map to find two identifiable positions to shoot a resection off of, I simply look at the screen of a great technological piece of gear and get a location immediately.

My rifle looks like it came from a science fiction movie today in comparison to 20 years ago. I have infrared lasers, broomstick handles, magnified optics, ambient light-gathering passive sights in three or four variations, a thermal sight, three-point combat slings, spare magazine pouches that attach to the buttstock, and an aimpoint laser available now, just as additions to my rifle.

I used to cover my head with a simple two-piece helmet that always fell into my eyes when I tried to get into any of the marksmanship firing positions. Now my head is adorned with more gadgetry than my family Christmas tree. I have a personal role radio (PRR) that has to be put on first, with a cable to the transmitter on my shoulder. I put on Wiley X goggles that afford me some eye protection—day and night. I have a one-piece helmet that still falls into my eyes no matter what firing position I attempt (and fail) to get into. On top of the helmet are night vision goggles (NVGs) that collect ambient light and can see the infrared laser on my rifle.

If I'm a squad leader or higher, I'm likely to be carrying a second or third radio in order to maintain communications in dispersed formations. I'll have the AN/PRC-148 squad radio or the AN/PRC-119 radio to maintain situation awareness to higher headquarters.

I still carry my K-bar or bayonet as issued, but I also have a Gerber multitool to perform the daily functions I constantly get involved in. I need the multitool just to adjust and wear the equipment I've been issued.

In addition to the two canteens I now have a Camelbak personal hydration system with a hose to drink from. This is a critical addition and great piece of gear, but still it is an addition to the combat load.

I have an improved first aid kit to replace the one I've carried for 20 years, but this one is twice the size as the original.

I only carry two handgrenades now vice the four I was able to carry on the original magazine pouches, so I have reduced 1 full pound of weight at the expense of fighting capability.

Although I still have a butt pack, I seldom use it since I can't sit down in my form of movement (truck, helicopter, etc.), opting instead to use my 3-day assault pack to carry what normally went into the butt pack. Inside my assault pack will be the gloves, dry socks, spare T-shirt, weapons cleaning gear, and whatever mission essential items I'll need. I will likely have spare AA batteries as I now have many items that are using batteries in comparison to 20 years ago (GPS, PVS-7B NVGs, AN/PEQ-2, and PRR at a minimum usage of eight batteries per day).

I wear Hatch protective fighting gloves and carry a wrist compass, two ink pens, and a notepad as all Marines have been taught. I wear kneepads, unless I'm in an extremely soft earth environment. I carry binoculars, black tape on a D-ring, a couple of map pens, a whistle, a flashlight, a spare knife with a strong back in order to rip out stuck cartridges from machineguns, and an Iridium phone since I'm often out of radio range of my commander.

All of this is before I receive my mission essential ammunition load. I'm likely to have 180 spare rifle bullets, extra fragmentation grenades, smoke grenades of various colors to mark landing zones or screen against enemy fire, and a red star cluster to cease fire if I'm being engaged by friendly forces. I may have a claymore mine for hasty defensive protection, some explosives for urban breaching, a breaching kit consisting of sledgehammers, bolt cutters, or hooligan tool, as well as a potential AT-4 rocket for any antiarmor or vehicle engagements.

Keep in mind that I'm not normally the infantry mule either. I'm a chief warrant officer, so just imagine what the private first class or lance corporal has to carry. Perhaps they won't have the Iridium phone, but there isn't much else they'll be able to take off. Because they're young, they'll likely have added a Gameboy, digital camera, DVD (digital versatile disc) player with movies, and a Walkman or new digital music player with associated spare batteries as well. What of the M203 grenadier or the automatic rifleman? The grenadier adds the weight of the M203 and his 18 1/2 pounds of ammunition. The automatic rifleman exchanges an 8-pound rifle and ammunition for a 17-pound machinegun with four 7-pound drums of ammunition. We'll leave weapons company Marines armed with 81mm mortars, M2 and Mk19 machineguns, and Javelin or TOW missiles completely out of the discussion, as it simply isn't logical to think of them as foot-mobile anymore.

What More Is in Store?

On 24 May 2004, I saw an article in the *Marine Times* discussing hot new gear proposed by the Marine Corps Warfighting Laboratory (MCWL). This article, titled "Small Units, Big Impact" by Gordon Lubold, identified even more gear to come the infantryman's way. The proposals were (1) target location handoff system, (2) thermal imaging binoculars, (3) Iridium expeditionary tactical communications, (4) Iridium point-to-point satellite communications, (5) Ground Laser Target Designator II, (6) Vector 21 laser rangefinding binoculars, and (7) a dismounted digital automated communications terminal.

This is not a ridiculous thought either. These are mission essential equipment identified over years of actual missions and detailed analysis. Without delving into the training time required just for the equipment additions—let alone the previous equipment, tactics, techniques of employing the equipment, and tactics or procedures to use the equipment or operate the squad—we should seriously consider the combat load of the individual.

Combat load isn't the entire problem either. Infantryman can get stronger and carry the load, but we can't do so rapidly, over long durations, and at high operating tempos as we are expected to. The MCWL proposal adds five advanced light strike vehicles to provide mobility, power generation, supply transport, weapons systems, and seating (also requiring training on driving, firing the weapons system, use of the power generation system, maintenance of the vehicle, etc.).

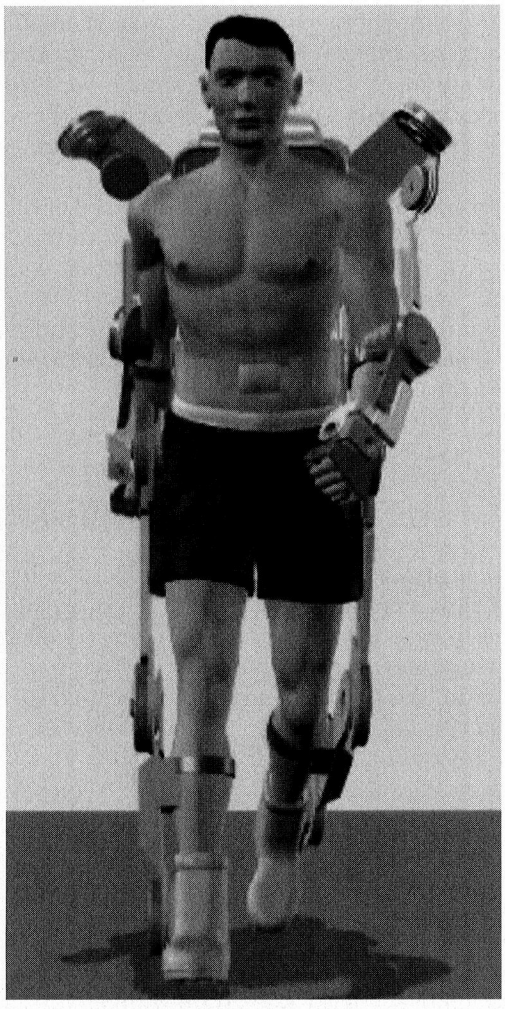
Without delving into the training time required just for the equipment additions . . . we should seriously consider the combat load of the individual.

The real problem is mobility. I feel like I'm in a straitjacket of protection and equipment. If I drop an ink pen at my feet I seriously consider just buying a new one so I don't have to go through the effort of trying to pick up the one from the ground. I'm not lazy, just afraid I'll lose my balance trying to bend over and pick up the pen, so I consider my options and look to see if anyone is watching before deciding to leave it or attempting to pick it up. I'm deadly serious also. This is not my normal sarcasm but a fact of today's life as an infantryman. The knights who fought at Agincourt must have felt the same way. A common cause of death for a knight was falling off of his horse and being unable to get back up. He starved to death, drowned in the mud and muck underneath him, or was killed by whoever walked up with a sword after his fall. Is the infantryman to suffer the same fate?

The infantryman already has his *Training and Readiness (T&R) Manual* that has approximately 4,100 pages of required skills. Training time is scarce and deployments so rapid that we can't conceive we're actually doing what we're doing. This *T&R Manual* does not include most of the equipment we currently use and none of the proposed ideas of MCWL.

In 2001 the Infantry Operational Advisory Group recommended key weights during different times of movement toward the enemy. Those weights were as follows:

Exoskeleton system images. *(Photo courtesy of MCWL.)*



Concept: powered exoskeleton. *(Courtesy of the Exoskeleton Transition Support Working Group.)*

• *Existence load.* The existence load is defined as that load taken from the point of origin into the assembly area. The existence load, for planning purposes, will be intended to support the individual from his pack when immediate resupply is impossible. From the perspective of human factors, the maximum weight of the existence load will be such that the average infantry Marine will be able to conduct limited movement in the confines of naval shipping, embark and debark aircraft, and conduct limited marching from a landing zone into a secured area. The maximum weight of the existence load is *150 pounds* (includes the weight of individual clothing, ballistic protection, and helmet).

• *Approach march load.* The approach march load is defined as that load necessary for the prosecution of combat operations for extended periods with access to daily resupply. The approach march load is intended to provide the individual infantry Marine with the necessities of existence for an extended period of combat. From the perspective of human factors, the maximum weight of the approach march load will be such that the average infantry Marine will able to conduct a 20-mile hike during a time frame of 8 hours, with the reasonable expectation of maintaining 90 percent combat effectiveness. The maximum weight of the approach march load is *70 pounds* (includes the weight of individual clothing, ballistic protection, and helmet).

• *Assault load.* The assault load is the load needed during the actual conduct of the assault. It will include minimal equipment beyond water and ammunition. From the human factors perspective, the maximum assault load weight will be that weight at which an average infantry Marine will be able to conduct combat operations indefinitely with minimal degradation in combat effectiveness. The maximum weight of the assault load is *40 pounds* (includes the weight of individual clothing, ballistic protection, and helmet).

Based on actual experiences, there is no reasonable way to follow the combat load guidelines developed in the 2001 Infantry Operational Advisory Group findings that are listed above. The assault load of the average infantryman—when complete with uniform, helmet, interceptor vest, Camelback hydration system, first aid kit, seven magazines of ammunition, compass, GPS, K-bar or bayonet, one M16A4 with advanced combat optical gunsight and AN/PEQ-2, NVGs, two handgrenades, one hydrogen chloride smoke grenade, one red star cluster, ink pens, pocketknives, note pads, map pens, maps, eye protection, gloves, flashlights, spare batteries, PRRs or AN/PRC-148 radios—easily falls into the approach march load, rapidly exceeding the assault load and draining the energy of the fighting Marine before contact with the enemy is made.

The answer to our increasing dilemma of combat load may have been identified in Robert A. Heinlein's book, *Starship Troopers* (1959). Forget the movie and read the book to see how dispersion increased with matching lethality for the characters in Heinlein's book. In the story one man had a strength-enhancing exoskeleton suit. The suit protected him from the environment, to include chemical or biological worries. The suit cooled him during hot weather and warmed him during cool weather. It allowed the wearer to jump over buildings and run across countrysides faster than today's vehicles. There were built-in communications, optics, protection, and strength. One individual attacked and destroyed entire cities that today would take corps-level forces if not a field army.

. . . there is no reasonable way to follow the combat load guidelines developed in the 2001 Infantry Operational Advisory Group findings. . . .

Heinlein was making a technology leap that projected forward a historical trend of technology-enabled advances in individual lethality and ability to disperse forces effectively on the future battlefield. He was pro-

jecting technology enhancements to the individual soldier or Marine. In many ways his projection has been accurate since we have added advanced optics, NVGs, and improved communications that permit the dismounted infantryman potential access to the lethality of joint fires. What we have not done is attacked the basic problem of the equipment load that he has had to carry.

This may be about to change. On 25 May 2004, LtGen Jan C. Huly, Deputy Commandant, Plans, Policies, and Operations (DC PP&O), as the Ground Combat Element Advocate, signed a universal need statement (UNS) for a Marine exoskeletal performance augmentation capability. This UNS explicitly identifies the potential applications of the Defense Advanced Research Projects Agency exoskeleton program to:

> . . . increase the speed, strength, and endurance of soldiers and Marines in combat environments. By defining an opportunity-based need in the context of known warfighting utility, the Marine Corps has an opportunity to influence this technology in its infancy, guiding, and tangibly leveraging its development to application-specific objectives.[1]

Clearly the need for this capability has been recognized by the senior leadership of the Marine Corps. Now it is up to the science and technology community to capitalize on this research and drive development into military applications. Perhaps with time, technology will provide the solution to the dilemma of the infantryman's load that it has in recent years seemed to increase rather than reduce. I hope I get to see it on my watch. In the meantime, excuse me while I find a working party to assist me in putting on my fighting load.

Note

1. DC PP&O letter to Commanding General, Marine Corps Combat Development Command, "Marine Exoskeletal Performance Augmentation Capability (MEPAC) Universal Need Statement (UNS)," 25 May 2004.

US MC

No Photo Available

>CWO4 Eby was the Regimental Gunner, 7th Marine Regiment. He is currently assigned to Weapons Training Battalion, Quantico.